

RELATIONSHIP BETWEEN CANOPY DENSITY AND BREEDING BEHAVIOUR OF *PLOCEUS PHILIPPINUS* (LINN.) AND *PLOCEUS BENGHALENSIS* (LINN.)¹

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(With two text-figures)

INTRODUCTION

The baya or Indian weaver bird *Ploceus philippinus* avoids heavy forest and prefers open cultivation (Whistler 1928). Such habitat selectivity could be observed prominently during the breeding season. Besides open cultivation, other similar open areas like scrub jungles (Mathew 1972), wells in the midst of bajra cultivation (Ali and Ambedkar 1957), isolated trees (Ali 1956), structures like house eaves (Davis 1971), telegraphic and power lines (Ambedkar 1970) are occasionally selected for hanging their nests. Adam (1873) has also noticed *P. philippinus* breeding in open plains in Rajasthan (Rajputana).

Like *P. philippinus*, *P. benghalensis* also avoids wooded areas (Ambedkar 1972). This species requires open grasslands and reed beds for nesting.

From the available literature, one can conclude that *Ploceus philippinus* and *P. benghalensis* are birds of open areas; but how much 'openness' they require, is not known so far. In the present paper the magnitude of 'openness' is quantified for two species of weaver birds in Rajasthan.

STUDY AREA

This study was conducted at Tatarpur Mixed Plantation A, B and C (27° 47' N, 76° 31' E) in Alwar district of Rajasthan. It is an undulating hilly area which is very prone to biotic interference. Earlier, this area was under dense forests; but due to overgrazing and illicit felling and lopping, the vegetative growth was destroyed. The area had become barren with stunted and sparse growth of *Prosopis spicigera*, *Zizyphus jujuba*, *Z.*

nummularia, *Leptadenia sparitum*, *Calotropis procera*, *Acacia senegal*, *A. leucophloea*, *A. jacquemontii*, *Maytenus emarginata*, *Capparis decidua*, *C. sepiaria*, *Butea monosperma*, *Adhatoda vasica*, *Holoptelia integrifolia*, *Saccharum bengalense* and other grasses. In the upper reaches of the hills, *Anogeissus pendula*, *Acacia senegal* and *Rhus mysurensis* were dominant species.

The area lies between hill ranges, followed by agricultural land. Water sources are very limited. A small seasonal hill stream flows in the rainy season, but for a greater part of the year the area remain arid. The rainy season is July and August, with average rainfall of 696 mm. Rainy days are limited 50 to 70 days.

Bajra *Pennisetum typhoides* is the main monsoon crop.

In 1981, 66 ha of this area was fenced and taken up by Forest Department to develop a mixed plantation. The whole area was divided into three parts, A, B and C, with areas of 20, 23 and 23 ha respectively. The planting of seedlings was completed from July to August at a spacing of 5 x 5 m. *Acacia tortilis*, an exotic species, was introduced in the area on a large scale. *Dalbergia sissoo*, *Eucalyptus* spp., *Leucaena leucocephala*, *Parkinsonia aculeata*, *Acacia nilotica* and *A. auriculiformis* were also planted in the area.

MATERIAL AND METHODS

All three plantations were surveyed annually from May to October. The annual working schedule was as follows:

May to June: Canopy density was estimated every year from May to June, before commencement of monsoon. For this purpose, 10% random sampling of the area was done. Sample plots of 20 x 20 m size were laid out on the ground, using lime powder for demarcation of boundaries. Stones

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TABLE 1
NESTING OF *Ploceus philippinus* AT TATARPUR MIXED PLANTATIONS A, B AND C FROM 1980 TO 1990

Year	No. of colonies in plantations						Total 66 ha	
	A (20 ha)		B (23 ha)		C (23 ha)		Nest trees	Nests
	Nest trees	Nests	Nest trees	Nests	Nest trees	Nests		
1980	0	0	8	44	11	34	19	78
1981	0	0	14	73	12	27	26	100
1982	18	57	27	128	21	178	66	363
1983	21	109	21	69	37	225	79	403
1984	33	171	23	77	31	192	87	440
1986	12	43	10	41	27	161	49	245
1987	3	20	1	4	30	42	34	66
1988	0	0	4	16	9	56	13	72
1989	0	0	6	36	10	78	16	114
1990	0	0	4	14	9	56	13	70

No data available for 1985.

TABLE 2
NESTING OF *Ploceus benghalensis* AT TATARPUR MIXED PLANTATIONS A, B AND C FROM 1980 TO 1990

Year	No. of colonies in plantations						Total 66 ha	
	A (20 ha)		B (23 ha)		C (23 ha)		Nested clumps	Nests
	Nested clumps	Nests	Nested clumps	Nests	Nested clumps	Nests		
1980	23	44	5	11	9	22	37	77
1981	29	58	4	6	8	19	41	83
1982	33	63	6	13	11	24	50	100
1983	21	41	1	2	3	5	25	48
1984	19	29	0	0	7	14	26	43
1986	9	17	1	1	2	3	12	21
1987*	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0

An isolated nested tree or clump was considered as one colony. No data available for 1985.

**Saccharum bengalense* Retz. disappeared from the area from 1987 to 1990.

were partially buried on the boundaries of each plot to make their identification easier in coming years. Then a long light bamboo rod, with a spirit-level attached, carried in the vertical position (as checked by the spirit-level), was used to mark out as closely as possible the crown of each tree in each sample plot. The outline of each crown was drawn on the ground directly below the crowns; this represented the 'dripline' of the tree. The area occupied by an individual crown was estimated by dividing the area enclosed by the dripline into

various geometrical figures. Canopy density was calculated as the ratio between total area occupied by the crowns and the sample plot area. The density scale therefore ran from 0 to 1 (entire area under canopy cover). Canopy density was classified into four categories:

- (i) Closed – when the density is 1.0, (ii) Dense – density less than between 0.75 and 1.0, (iii) Thin – density between 0.50 and 0.75, and (iv) Open – density less than 0.50.

RESULTS

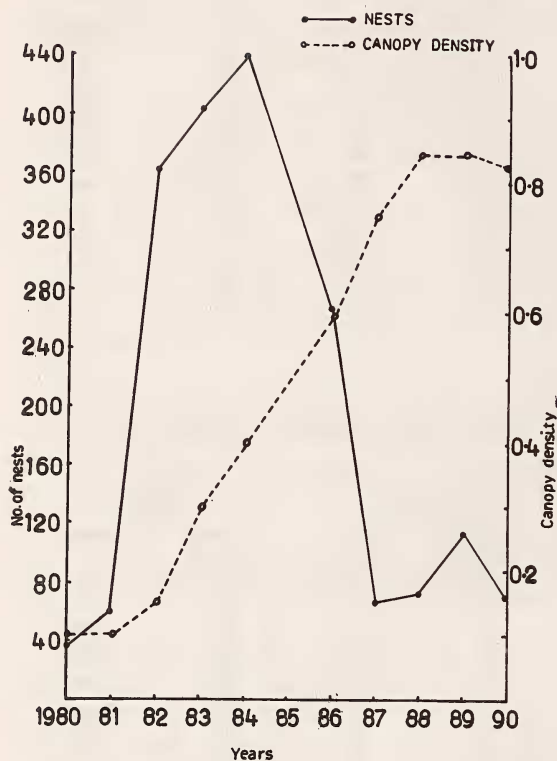


Fig. 1. Relationship between canopy density and number of nest colonies of *Ploceus philippinus* at Tatarpur Mixed Plantations A, B, C.

September to October: With the withdrawal of the south-west monsoon in September or October, breeding activities of weaver birds ceased. By this time the maximum numbers of the host trees and other forms of plants would have been engaged by breeders for colonisation. Trees and other forms of plants occupied by weaver birds for nesting were counted annually along with intact nests present on patronised plants (Tables 1, 2).

Due to protection of the area and re-stocking of plantation, canopy density of the area increased gradually in subsequent years. The number of trees and other forms of plants occupied for nesting also increased correspondingly due to the following reasons:

(i) Minimization of biotic interference; (ii) availability of more suitable new host plants for nesting from planted crop; (iii) availability of additional host plants from degraded earlier natural growth due to protected regeneration; (iv) availability of fabricating material at nesting site from ungrazed *Saccharum bengalense* Retz. thickets.

The above relationship lasted until the crown contact stage was reached. After this stage, with further increment in canopy density, weaver birds were gradually displaced from the area. During later years, they abandoned the areas for nesting due to the gradual decrease in openness, and the shortage of nesting material, resulting from the natural eradication of fibre-yielding grass (*Saccharum bengalense* and others) due to lack of sunlight.

While most of the breeders were moving from the inner denser parts, many were still seen in the peripheral zone, using various plants for nesting but comparatively in smaller numbers (Figs. 1, 2).

With the gradual decrease of openness in the inner denser parts, weaver birds shifted their breeding activities to the peripheral zone at the outskirts of the plantation, where the wooded area thins out into open area. The 'canopy density' and 'crop density' generally remain low in this ecotonal zone due to biotic interference. Peripheral strips were therefore used for nesting in subsequent years.

No weaver bird nest colony was seen in area 'A' during 1990, due to the high canopy density in the area. Areas 'B' and 'C' were also neglected by *Ploceus philippinus* and only four and nine nest colonies respectively were seen in that year. Similarly, *Ploceus benghalensis* completely

TABLE 3
 PROGRESS IN CANOPY DENSITY IN DIFFERENT YEARS AT TATARPUR MIXED PLANTATIONS
 A, B AND C FROM 1980 TO 1990

Year	Age of plantation in July	Condition of vegetation	Rainfall	Canopy condition	Approx. average canopy density at end of June
1980	—	Vegetation sparse, highly degraded, heavy biotic interference; <i>Saccharum bengalense</i> abundant.	Normal	Widely open	0.1
1981	0	Plantation done in July to re-stock the area; area fenced, biotic interference minimised, <i>Saccharum bengalense</i> abundant.	Normal	Widely open	0.1
1982	1	Vigorous growth in planted saplings, biotic interference minimised, <i>Saccharum bengalense</i> abundant.	Normal	Widely open	0.15
1983	2	Length-wise and sideways growth good, improvement in ground flora, biotic interference minimised, <i>Saccharum bengalense</i> abundant.	Normal	Open	0.3
1984	3	Expansion in crowns, development of microclimate continued, biotic interference minimised. <i>Saccharum bengalense</i> not flourishing in shady areas.	Sub-normal	Less open	0.4
1986	5	As in 1984.	Normal	Crown contact stage in a few pockets	0.6
1987	6	Along nallahs, canopy became closed; <i>Saccharum bengalense</i> disappeared from many shady pockets; illicit browsing practiced.	Severe drought	Crown overlapping started in a few pockets	0.75
1988	7	Besides a few pockets, most of the area became closed due to good crown growth; grassy ground flora disappeared from shady areas, <i>Saccharum bengalense</i> completely disappeared from most parts of the area.	Above normal	Crown overlapped in most of the area	0.85
1989	8	As in 1988. Illicit browsing continued.	Normal	As in 1988	0.85
1990	9	Illicit grazing, browsing with felling and lopping in many pockets. Fencing of barbed wire partially destroyed by graziers to facilitate illegal grazing.	Normal	As in 1988	0.83

No data available for 1985.

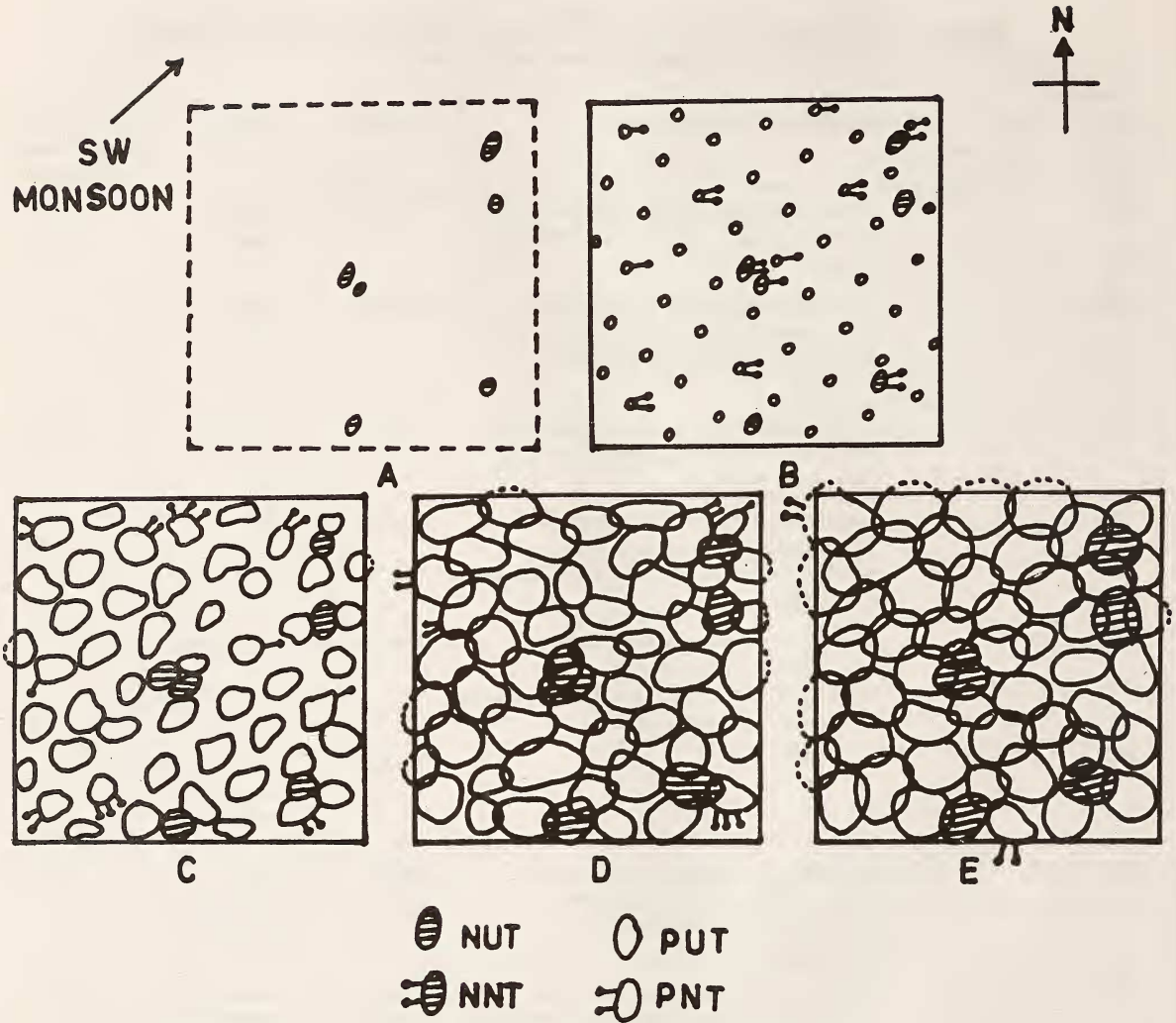


Fig. 2. Nesting patterns of *Ploceus philippinus* in the less undulating parts of Tatarpur Mixed Plantations.

A. 1980, before planting. Very few suitable nesting trees. Area unfenced. B. 1982: Canopy widely open. Area fenced. Planting at 5 x 5 m spacing done in 1981; both planted and earlier (natural) trees used for nesting. C. 1986, beginning of crown contact stage in some pockets; nesting activities shifted towards periphery. D. 1987, beginning of crown overlapping stage in some pockets, beginning of crown contact stage in most of remaining area. E. 1988, crown overlapping advanced. Nesting quickly disappeared in deeper parts.

NUT = Natural un-nested tree, NNT = Natural nested tree, PUT = Planted un-nested tree, PNT = Planted nested tree.

abandoned the area from 1987 onwards (Tables 1, 3).

Due to increase in canopy density, *Saccharum bengalense* also disappeared from the area for want of sufficient light. Before 1980, when this area was open, *Saccharum bengalense*

was common. Before 1984, nest colonies of *Ploceus bengalensis* could be seen in sufficient numbers (Table 2), but after 1987, not even a single nest colony could be traced in any of the three plantations (Table 2).

DISCUSSION

It is clear from the study that weaver birds cannot utilise man-made plantations year after year. Canopy density plays an important role as a limiting factor. A planted area is preferred by weaver birds till it reaches the 'crown contact stage'. Beyond this stage, weaver birds move from the area towards more open parts which are available within the area, or in other areas.

Openness of the area is important for several reasons:

(i) Thick growth reduces audibility of breeding songs of advertising cocks.

(ii) Nest building cocks display to attract the nest-inspecting females. Such displays cannot be seen if visibility in the area is poor. If there is thick growth around nesting hosts, neither the displaying cock nor his nest will be seen from a distance by females.

Besides audibility and visibility, one may suspect the effect of other causes such as influence of predators along with density of vegetative cover. Predation was not common in the area, and did not change in intensity during the study. A very few raids by house crows *Corvus splendens* were

noticed in plantation 'C' on an *Acacia senegal* based huge colony of *Ploceus philippinus* in a nallah during 1982 and 1983. One incident of house crow attack was noticed in plantation 'B' in 1984.

The population of jungle crows *Corvus macrorhynchos* is extremely low in the locality and this species was never seen stealing eggs and chicks from the nests of weaver birds in the study area. Neither snakes nor raptors were noticed on weaver nests. However, once in the summer of May 1983, a grey shrike *Lanius excubitor* was noticed perching on the chinstrap of a half-built nest of *Ploceus philippinus*. However, shrikes were not observed hunting in the nest colonies during the breeding season of weavers.

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